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(19) (CA) **CANADIAN PATENT** (12)

(54) Clamp for Shoring and Scaffolding Frames

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ABSTRACT OF THE DISCLOSURE

Clamp for Shoring and Scaffolding Frames

5 A clamp arrangement for use in interconnecting  
structural members such as those used in scaffolding and  
shoring framework comprises two clamps which can be  
interconnected for either rotation between the clamps or  
fixed positioning of the clamps in at least one  
10 predetermined position. The clamps in the area of  
interconnection have portions which are adapted to be  
secured to position the clamps in the corresponding  
predetermined fixed relative position. A securing  
device cooperates with the clamp portions for securing  
15 them to fix the clamps in the corresponding  
predetermined relative position.

1     FIELD OF THE INVENTION

2     This invention relates to clamps and clamp arrangements for  
3     us in interconnecting structural members and mor  
4     particularly to clamps which have the facility for either  
5     unrestricted relative rotation or one or more fixed relative  
6     positions.

7     BACKGROUND OF THE INVENTION

8     Clamps are used in many areas for interconnecting structural  
9     members in the mechanical assembly of components. Clamps  
10    may be used in the positioning of light fixtures, on  
11    laboratory equipment and on scaffolding and shoring frames  
12    used in construction, to name only a few. With particular  
13    reference to the construction field, several arrangements of  
14    clamps have been developed over time which are particularly  
15    suited for clamping tubes and the like to shoring and  
16    scaffolding frames in assembling the framework so as to  
17    support the frames in forming columns and the like.  
18    Normally such clamps are designed to clamp one circular tube  
19    to another circular tube where the clamps are fixedly  
20    secured to one another. This is usually accomplished by  
21    having common clamp jaws integrally formed. Examples of  
22    such clamps are disclosed in United States Patent 1,706,214  
23    and United States Patent 2,194,883. These patents are  
24    representative of scaffolding clamps which are fixed to  
25    clamp one tubular member at 90 degrees or at 45 degrees  
26    relative to the other tubular member.

27    There are however situations where in clamping one  
28    structural member to another their angular relationship may  
29    not always be that defined by a particular fixed clamp  
30    arrangement. Thus swivel interconnections having



1       unrestricted relative rotation between the clamps were  
      devised to accommodate variations in angular relationships  
      between the members to be clamped. The difficulty with a  
5       swivel-type clamp is that in not fixing the relative  
      positions of the members, the assembled structure may permit  
      some movement and is therefore somewhat weaker for  
      supporting loads. Examples of swivel-type clamps are  
      disclosed in United States Patent 2,945,713, Australian  
10       Patent 152,133 and Canadian Patent 369,685. The Australian  
      Patent discloses that the swivel connection can be fixed by  
      simply welding the components together to provide the fixed  
      arrangement. Also in Canadian Patent 369,685 alternative  
      configurations are shown for fixed interconnections which is  
      similar to that disclosed in United States Patent 1,706,214.

15       Attempts have been made to provide a type of clamp  
      arrangement which has the advantages of swivelling between  
      the clamps and provision for fixing the relative positions  
      for the clamps. Examples of such clamps are disclosed in  
20       United States Patent 1,706,215 and Canadian Patent 356,357.  
      The clamp arrangement of United States Patent 1,706,215 may  
      be swivelled to a desired position with the ratchet teeth  
      separated and then upon meshing the teeth and tightening a  
      bolt to secure the meshed ratchet teeth, a desired fixed  
25       positioning of the clamps is achieved. With Canadian Patent  
      356,357 the clamps may swivel relative to one another  
      through a distance predetermined by the arcuate slot in one  
      clamp body portion. Upon tightening of the bolt the clamps  
      are fixed in a desired position. In this arrangement the  
30       distribution of loads for the device in fixing the clamps'  
      positions is offset from the central axis about which the  
      clamps can rotate. This unequal distribution of the loads

1 does not provide for a secure clamp interfit and can result  
in failure of the clamps when placed under load. Secondly,  
th clamp does not offer a full swivel of the interconnected  
clamps without restriction.

5

With the ratchet tooth arrangement of United States patent  
1,706,215, the teeth are separated to provide for relative  
rotation between the clamps. The interconnection for the  
clamps has not, however, been adapted in any way to maintain  
10 separation between the teeth for rotation. Instead the  
interconnection is such that the teeth of the ratchet  
arrangement are meshed when the clamp is in use. To  
withstand the loads which may be exerted on the clamp, the  
teeth should be constructed of a harder metal, such as steel.  
15 Thus care in design must be exercised when the arrangement  
is made of less hardenable metals.

The clamp arrangement according to this invention overcomes  
the above problems in providing an interconnection for  
20 clamps which is adapted to give either rotation between the  
clamps or positioning of the clamps in at least one  
predetermined fixed relative position.

#### SUMMARY OF THE INVENTION

25 The clamp arrangement, according to this invention, is  
interconnected in a manner to provide for either rotation  
between the clamps or positioning of the clamps in at least  
one predetermined fixed relative position. Such  
interconnection is provided by at least one portion of at  
30 least one clamp in the area of clamp interconnection which  
is adapted to be secured to position the clamps in the at  
least one fixed relative position. Means cooperates with

1 and contains the clamp portion for securing it in its  
relative position. The connection may be completed in a  
manner to balance the distribution of stresses on this  
securing means about the axis of interconnection when the  
5 clamp arrangement is under load.

More particularly the invention is embodied in a clamp  
having a clamp body which is releasably closeable to  
surround and clamp a structural member. The clamps in their  
10 area of interconnection have opposing portions which have a  
distinct relative orientation at each of the at least one  
predetermined fixed relative positions for the clamps.  
Means is provided for engaging said opposing portions when  
they are in each said distinct relative orientation to lock  
15 said portions and thereby provide the corresponding  
predetermined fixed relative positions for said clamps.

According to an embodiment of the invention the opposing  
portions of the clamps are matched and have external  
20 surfaces which are symmetrical about the axis of  
interconnection for the clamps.

According to another variation of the invention the matched  
portions for the clamps are in the form of non-circular  
25 apertures defined in each clamp body. The internal surfaces  
of each aperture are symmetrical about the longitudinal axis  
of the aperture. The clamps are interconnected with the  
longitudinal axes of the apertures coincident. The locking  
means is adapted for insertion in the apertures and bridges  
30 same to engage aligned internal surfaces to position the  
clamps in a corresponding fixed relative position.

1 The invention is also embodied in the securing means being  
integral with one or both of the clamps. On of the clamps  
may have an external shoulder arrangement which is engaged  
by the securing means integral with the other clamp, which  
5 may be in the form of a ridge arrangement which engages and  
contains the shoulder arrangement. Alternatively, the  
securing means may be formed on both clamps and arranged on  
each clamp to cooperate with and engage a corresponding  
opposing portion on the other clamp. In this alternative,  
10 the securing means may comprise at least one ridge integral  
with each clamp adapted for engaging a corresponding  
shoulder portion on the other clamp.

The clamp arrangement may also be adapted for interconnecting  
15 at least two clamps all along a common axis about which the  
clamps can rotate relative to one another. Thus each clamp  
jaw has on its exterior between its hinge point and its free  
end a shoulder means arrangement which is symmetrical about  
the axis and which cooperates with a similar shoulder means  
20 arrangement on an adjacent clamp jaw. The shoulder  
arrangements determine when aligned, at least one fixed  
relative position for adjacent clamps. Means cooperates  
with and engages the aligned adjacent shoulder means to  
secure them and thereby provide the corresponding fixed  
25 relative position for the adjacent clamps.

The clamps are particularly suitable for use with a  
scaffolding and shoring framework such as framework made of  
aluminum alloys as disclosed in co-pending Canadian Patent  
30 Application S.N.'s 370,086 filed February 4, 1981 and  
374,624 filed March 27, 1981. The clamps may be formed of  
aluminum alloy where the clamps may be individually formed

1 from an extruded section of aluminum alloy.

BRIEF DESCRIPTION OF THE DRAWINGS

5 Preferred embodiments of the invention are shown in the drawings wherein:

Figure 1 is a perspective view showing a tubular brace connected to a tubular leg by a clamp arrangement according to a preferred embodiment of the invention;  
10 Figure 2 is a perspective view of a tubular brace clamped to a tubular leg in a fixed position by a clamp arrangement according to a preferred embodiment of the invention;  
Figure 3 is a top plan view showing the clamp arrangement interconnecting two tubular members in parallel relationship;  
15 Figure 4 is an exploded view of the clamp arrangement of Figure 3;  
Figure 5 is a top plan view of the clamp arrangement of Figure 4 showing various positions in closing the clamp about a tubular member;  
20 Figure 6 is an enlarged view of the connector of Figure 4 for interconnecting clamp members;  
Figure 7 shows an alternative embodiment of the device for securing clamps in desired predetermined fixed positions;  
Figure 8 shows the arrangement of Figure 7 used to interconnect adjacent clamp jaws in a 45 degree angular  
25 position;  
Figure 9 shows an alternative embodiment for interconnecting adjacent clamp jaws of a clamp arrangement and for providing predetermined fixed relative positions for the clamps;  
Figure 10 shows an alternative embodiment for interconnecting adjacent clamp jaws of a clamp arrangement;  
30 Figure 11 shows the clamp jaws of a clamp arrangement interconnected by the device of Figure 10;



1     Figur 12 shows an alternative embodiment for  
interconnecting adjacent clamp jaws;  
Figure 13 is a perspective vi w of a clamp having a cam  
arrangem nt for closing the clamp:  
5     Figure 14 is a side elevation of the clamp closure device of  
Figure 13;  
Figure 15 is a perspective view of a clamp having an  
alternative embodiment for the clamp closure device;  
10    Figure 16 is a side elevation of the clamp closure device of  
Figure 15;  
Figure 17 is a perspective view of an alternative embodiment  
for the clamp closure device; and  
15    Figure 18 is a top plan view of the clamp closure device of  
Figure 17.

#### DETAILED DESCRIPTION OF THE PREFERRED EMBODIMENTS

The clamp arrangement according to this invention can be  
used to connect structural members of the same or different  
20    configuration at any angular relationship as provided for by  
rotating the clamps to the desired position or any desired  
angular relationship in a fixed manner. As will be learned  
from the description of the preferred embodiments, various  
approaches may be taken in providing for such clamp  
25    interconnection as dependent upon the uses the clamps will  
have in various configurations. To better understand the  
invention, the clamp arrangement is described with respect  
to use in scaffolding and shoring framework, however, it is  
understood that the invention is also embodied in other  
30    clamp arrangements as previously defined such as laboratory  
clamping equipment, shelving clamping equipment, light  
fixture clamping equipment, etc.

1 The clamp 10 as shown in Figure 1 is interconnected so as to  
provide for swivel or relative rotation between the  
interconnected clamp bodies 12 and 14. The clamps  
interconnect round tubular member 16 to a somewhat square or  
5 rectangular member 18. In the scaffolding and shoring field  
member 18 may be a leg of a frame and structural member 16  
may be a length of tube used to interconnect and steady a  
frame leg. Each clamp 12 and 14 is provided respectively  
with clamp closure devices 20 and 22 which squeeze the  
10 clamps around the respective structural member 16 and 18 so  
as to grip the structural members to effect a secure clamped  
interconnection. To prevent crushing or over clamping of  
the structural members the clamp jaws 24 and 26 of clamp 12  
may be provided with opposing abutments 28 and 30 which  
15 prevent overtightening in clamping the tube 16. Similarly  
with clamp 14, clamp jaws 32 and 34 have opposing abutment  
portions 36 and 38 which also prevent overclamping and  
crushing of the frame leg 18. This is advantageous in  
instances where the structural members 16 and 18 are made of  
20 materials which can be crushed such as tubing of plastic or  
reinforced plastic or fiberglass or thin wall metal tubing  
for both the members 16 and 18.

As shown in Figure 1, the clamps 12 and 14 are free to  
25 rotate relative to one another to allow positioning of the  
brace member 16 at any desired angular relationship relative  
to the frame leg 18. Once the clamps are secured to the leg  
and the brace is secured at the other end, the clamp  
position remains relatively unchanged.

30 In the area 40 of interconnection, matched portions are  
provided in the form of shoulders 42 and 44 of the adjacent

1 clamp body jaws 26 and 34. Although the shoulders 42 and 44  
are shown as being planar, it is appreciated that the  
shoulders may take on other shapes, particularly between the  
5 corners, as will be apparent when the locking device for the  
shoulders is discussed in respect of the other embodiments.  
As is more clearly shown on the clamp jaw body 24, the  
shoulders 42 oppose one another and shoulders 44 oppose one  
another as symmetrically distributed about the aperture 46  
10 of clamp jaw 24, whose axis is coincident with the axis of  
rotation of the clamps 12 and 14. As can be appreciated  
from Figure 1, upon relative rotation of the clamps 12 and  
14, the shoulders of the matched portions in the area of  
interconnection become aligned to define in this instance  
two distinct relative positions of the clamps 12 and 14.  
15 These two distinct positions are at 0 degrees, that is the  
tubular members would be parallel to one another and 90  
degrees where member 16 would be at right angles relative to  
the frame leg 18.

20 Turning to Figure 2, the clamp arrangement 10 is in one of  
its fixed relative positions where the tubular brace member  
16 is at 90 degrees to the frame leg 18. The shoulders 42  
and 44 of the area of interconnection 40 are aligned and a  
locking means or securement device 48 is provided to engage  
25 and contain the aligned shoulders and secure them in the  
position shown to fix the relative positions of clamps 12  
and 14. This arrangement of the abutment portions may be  
useful in the field to visually indicate to the workman by a  
narrow space or no space between the abutments the degree of  
30 tightness of the clamp on a member. In using the locking  
device 48, the position of tubular member 16 is fixed  
relative to the leg 18 within the limits of load that the

1 locking device 48 will withstand when the entire framework  
is under load. The particular arrangement of the securement  
device 48 relative to the matched aligned shoulder portions  
will be discussed in more detail with respect to Figure 3.  
5 As can be seen from Figure 2, the closure devices 20 and 22  
are firmly secured such that the abutting portions 28 and 30  
of clamp 12 and abutting portions 36 and 38 of clamp 14 are  
proximate so as to provide a secure clamping of the tubular  
member 16 relative to the frame leg 18.

10

Turning to Figure 3, the clamps 12 and 14 are secured by the  
securement device 48 in the 0 degree position where the  
frame leg 18 is parallel to the tubular brace 16. In this  
arrangement the opposing matched portions in the area of  
15 interconnection 40 are aligned as shown by the arrangement  
of shoulders 42 and 44. The locking or securement device 48  
is, according to this embodiment, a collar having an  
interior outline corresponding to the shape of the shoulders  
when aligned. Since in this embodiment the shoulders 42 and  
20 44 are all of equal length, the interior configuration of  
the collar 48 is that of a square and dimensioned so as to  
snugly receive and engage the shoulders 42 and 44 as shown.  
In the area of interconnection 40 the adjacent clamp jaws 26  
and 34 of interconnected clamps 12 and 14 are secured  
25 together by a bolt and nut arrangement shown generally in  
dot at 50. The longitudinal axis of the bolt and nut  
arrangement 50 is coincident with the axis of relative  
rotation of the two clamps 12 and 14. The bolt arrangement  
50 holds the adjacent clamp jaws together and with the  
30 collar snugly engaging the aligned shoulders 42 and 44, the  
clamps 12 and 14 are not permitted to rotate relative to one  
another thus providing the fixed relative position of the

1 clamps 12 and 14.

5 As is apparent from Figure 3, when the frame leg 18 and the cross bracing 16 are under load, forces would be exerted to attempt to rotate one clamp relative to the other about the axis of the bolt 50. This is resisted by the locking collar 48 which would be placed principally under tension as the shoulders attempt to stretch and deform the locking collar 48. Because the shoulders 42 and 44 are symmetrical or  
10 evenly distributed about the axis of rotation, then the loads applied to the interconnection are thus evenly distributed about the axis of rotation. Therefore, there are no high stresses exerted on the locking device in any one area offset from the axis of rotation. Instead they are  
15 evenly distributed about the axis of rotation as counteracted by the locking collar 48 to provide for a more secure interconnection of the clamps when providing for the corresponding fixed relative position for the clamps 12 and 14.

20 Clamp 12 has clamp jaw portions 24 and 26 which at one end are pivotally interconnected by hinge 52 about pivot pin 54. The free ends 56 and 58 of the clamp jaws are adapted to cooperate with the closure device 20. Closure device 20  
25 consists of a bolt portion 60 which is pivotally connected to clamp jaw free end 56 at 62. The other end of the bolt is threaded at 64 to receive nut 66. With the nut sufficiently out on the bolt thread, the bolt can be swung so as to clear free end 58. With the bolt removed from the  
30 free end 58, the clamp jaw 24 may lay open relative to clamp jaw 26 to permit positioning of the structural support or cross member 16 in the clamp 12. The hinge 52 may be adapted

1 to hold jaw 24 at 90 degrees relative to jaw 26 when the  
clamp is open to permit placement of brace 16 on the open  
jaw. By moving the clamp jaw 24 toward the closed position,  
the bolt 60 may be swung inwardly with the nut 66 and washer  
5 68 clearing the free end 58 and thereby permitting  
tightening of the nut 66 against the face 70 of free end 58  
to clamp the tubular member 16 in the clamp 12. The free  
end 58 is provided with a lip 59 to prevent the washer  
slipping off the flat 70 as the nut is tightened. As  
10 previously explained, abutment portions 28 and 30 limit the  
extent to which the clamp may be closed to avoid crushing of  
the tubular member.

Similarly with clamp 14, it comprises two clamp jaws 32 and  
15 34 which are hinged at 72 about a hinge pin 74. The free  
ends 76 and 78 are adapted to cooperate with the securement  
means 22 which has a bolt 80 pivotally connected to free end  
76 at 82 and threaded at its other end at 84 to receive a  
nut 86. As with clamp 12 and the leg member 18 within the  
20 clamp, the connector device 22 may be swung inwardly and the  
nut 86 tightened with washer 88 against face 90 of free end  
78 and clamp jaw 34. Faces 36 and 38 abut to limit the  
extent to which the clamp may be closed to avoid crushing of  
the tubular leg 18.

25 As can be seen, the interior faces of the clamp jaws of  
clamps 12 and 14 are adapted to mate or surround and engage  
the faces of the respective tubular members. With clamp 12,  
its internal clamp faces 92 are rounded to correspond with  
30 the configuration of the circular tubular brace member 16.  
On the other hand with the clamp 14, its internal faces 94  
are irregular, however, designed to engage various portions

1 of the leg exterior to clamp and grip such 1 g. The shaping  
of the clamp faces will be discussed in more detail with  
respect to Figure 5.

5 Turning to Figure 4, the exploded view of the clamps 12 and  
14 show the component parts of the clamp arrangement.  
Referring to the component parts of clamp 14, the clamp jaws  
32 and 34 are hinged by way of hinge pin 74. The clamp jaws  
have formed lug portions 96 and 98 which are offset from one  
10 another on clamp jaws 32 and 34 so as to provide a hinge  
connection when the pin is positioned through aligned  
apertures 100 and 102 of the respective lug portions.

The bolt 80 is connected to lug portions 104 of the free end  
15 76 of clamp jaw 34 by pin 106 extending through the aperture  
108 in the yolk portion 110 of the bolt. This permits the  
bolt 80 to swing or pivot freely of the free end. Similarly  
clamp jaw 32 is provided with lugs 112 which provide the  
faces 90 against which the nut 86 and its washer abut in  
20 closing the clamp 14.

With clamp 12, clamp jaws 24 and 26 are interconnected by  
hinge pin 54. Jaw 24 has lug portions 114 which are offset  
from lug portions 116 of jaw 26 so as to provide the hinge  
25 interconnection where the pin is inserted through the  
apertures 118 and 120 to be aligned. On the free ends of  
the clamp jaws 24 and 26 lug portions 122 and 124 are  
provided to cooperate with the closure device 20 in the  
manner discussed in respect of Figure 3.

30 As can be appreciated from the shapes of the clamp jaws of  
clamps 12 and 14 there are certain similarities which enable

1 the jaws to be made from extruded sections, particularly of  
aluminum alloy. As can be seen with clamp jaws 32 and 34,  
they are of identical cross section when positioned adjacent  
5 one another, where the cross-section is sheared to provide  
offset lugs 96 and 98 for hinge interconnection. With the  
lugs 104 and 112, each is provided by removing a central  
area 126 to define the slot 128 into which the bolt 80 is  
moved in effecting clamp closure. Similarly with jaw 34,  
10 area 130 is cut out to provide space to receive the yoke  
portion 110 of the bolt 80 for pivotally connecting it to  
the lugs 104 of the free end 76. Similarly with clamp 12  
the clamp jaws 24 and 26 may be fabricated from a length of  
extruded aluminum alloy having the particular cross-section  
shown.

15 According to this preferred embodiment the shoulder faces 42  
and 44 are provided between the hinge area and the free end  
of each clamp jaw. In providing each clamp jaw with these  
shoulders 42 and 44 and locating them so as to be  
20 symmetrical about the axis that each clamp arrangement  
rotates, then two or more clamps may be interconnected  
regardless of the configuration for which the particular  
clamp is configured to engage. Thus for clamp 14 which  
clamps a frame leg, when it is desired to secure the leg by  
25 using two tubular cross braces on each side of the leg,  
identical clamps 12 may be used one on each side of clamp  
14. Thus each clamp jaw is provided with the same matching  
portions between the jaw's hinge point and free end to  
facilitate interconnection of two or more clamps. To  
30 interconnect adjacent clamp jaws 26 and 34 a connector  
device generally designated at 50 is used which consists of  
a threaded bolt 132 having bevelled head 134. A bevelled



1 nut 136 is used to engage the threaded portion of bolt 132.  
The apertures 46 and 138 of clamp jaws 26 and 34 have their  
faces bevelled at 140 as shown on aperture 46 to mate with  
the slopes of bevelled head portion 134 and bevelled nut 136.

5

The bolt and nut arrangement is shown in more detail in  
Figure 6. The threaded portion 132 has an arcuate groove  
140 extending parallel to the longitudinal axis of the bolt  
50. The bevelled nut 136 has threaded interior portion 142  
10 with four spaced apart arcuate grooves 146. The grooves 140  
and 146 adapt the nut and bolt arrangement to provide for  
locking of the relative positions of the nut and bolt. To  
lock the relative positions when the nut 136 is threaded on  
to the bolt to the desired extent, one of arcuate grooves  
15 146 is aligned with groove 140 to define a circular channel  
into which circular pin 148 is inserted to lock the relative  
positions of the nut and bolt. The pin 148 may be of the  
type which is slightly compressed upon insertion into the  
circular channel so as to frictionally engage surfaces and  
20 remain within the nut. The pin can be knocked out by use of  
a nail or the like as driven through aperture 150 in the  
bevelled head 134. This nut and bolt arrangement permits  
interconnection of adjacent clamp jaws 26 and 34 to provide  
a swivel interconnection without the nut unthreading from  
25 the bolt during use of the clamp. The desired degree of  
frictional engagement between the clamp jaw faces is  
provided by selecting the appropriate position for the nut  
on the bolt.

30 Prior to assembly of clamp jaws 26 and 34, if it is desired  
to provide for one of the two fixed predetermined positions  
of the clamps, the collar 48 is placed between the clamp

1 jaws 26 and 34. The collar 48 is placed over the shoulders  
42 and 44 of one of the clamp jaws. The remaining clamp jaw  
is then placed within collar 48 at either the desired 0 or  
5 90 degree relative positions for the clamps. The internal  
surfaces 152 are all of equal length so as to snugly engage  
and thereby contain the square outline of shoulders 42 and  
44. With the collar in place engaging the matched shoulder  
portions, the bolt is inserted through aligned apertures 46  
and 138 to complete with nut 136 the interconnection of  
10 clamp jaws 34 and 26 in the desired fixed relative position.

Turning to Figure 5, the frame leg 18 has a particular cross  
section which enhances its structural strength from a load  
carrying aspect and also facilitates mechanical connection  
15 of cross bracing etc. to the leg. Further details of the  
leg shape and its purpose are disclosed in co-pending  
Canadian patent application S.N. 374,624. The clamp 14 has  
its internal surfaces 94 adapted to engage selected portions  
of the leg exterior about its corner portions 154 and  
20 sidewall portions at 156. With clamp jaw 32 positioned  
against one side of leg 18 the other clamp jaw 34 is pivoted  
about pivot point 72 where the free end 76 of the clamp jaw  
clears the leg so that the clamp may be moved towards its  
closed position and engage all faces of the legs in the  
25 areas 154 and 156. To accomplish this the free end 76 is  
sloped slightly outwardly as indicated at surface 158 so as  
to clear corner area 154 of the leg as the clamp is being  
closed.

30 It can be appreciated, based on the above description of a  
preferred embodiment of the invention, that several other  
approaches become apparent in providing for clamp

1 interconnection which gives either unrestricted relative  
rotation between the clamps or one or more predetermined  
fixed relative positions. The embodiments of Figures 7  
through 12 demonstrate variations of the embodiment of  
5 Figure 4 and alternate approaches for the interconnection.  
Figure 7 shows the clamp jaws 24 and 34 of the embodiment of  
Figure 4, however, a different locking device 160 is used.  
This configuration for the locking device 160 provides for  
four distinct fixed relative positions for the clamps,  
10 namely 0 degrees, 45 degrees, 90 degrees and 135 degrees.  
The 180 degree positions etc. around to 360 being duplicates  
of the above unless distinction should be made with respect  
to which way the clamp opens relative to the other clamp.  
To provide for the four distinct positions and using the  
15 same matching shoulder configurations 44 and 42, the locking  
device 160 has a somewhat star-shaped interior. The  
interior is made up of sets of surfaces 162 and 164 which  
are of equal length and are at 90 degrees relative to one  
another. Adjacent surfaces 166 and 168 are of the same  
20 length only at 135 degrees relative to respective surfaces  
162 and 164.

According to the embodiment of Figure 7 the 0 and 90 degree  
positions are defined by aligning the shoulders 42 and 44.  
25 The collar 160 engages the so aligned surfaces to secure  
them in position. However, to define the 45 degree and 135  
degree relative positions for the clamps the shoulders 42  
and 44 are not aligned. Instead their overall outline  
defines the interior shape for collar 160. Considering this  
30 embodiment and the embodiment of Figure 1 it is apparent  
that either the aligned shoulders in cooperation with the  
collar define the desired fixed relative positions or the

1 collar in combination with either aligned or misaligned  
shoulder positions define other or the same predetermined  
fixed relative positions for the clamps. Therefore  
5 according to this form of interconnection there is a wide  
variety of fixed relative positions which may be provided by  
this connection. In situations where it is desired to  
provide interconnection where the fixed positions are  
determined by aligned shoulders, it is appreciated that one  
10 can begin with three shoulders which are preferably of equal  
length to define a triangular arrangement for shoulders.  
The next shoulder arrangements would be a square, pentagon,  
hexagon, etc. to define respectively, the various relative  
fixed position for the clamps. To add variation to these  
15 basic configurations by misaligned shoulder orientations, a  
new outline for the collar is provided to secure the desired  
predetermined fixed position. When misaligning the  
shoulders a particular collar arrangement can be provided to  
determine only one fixed position for the arrangement and at  
20 all other shoulder relative positions, the collar will not  
cooperate with the shoulders to define another position.

Figure 8 shows the clamp jaw 24 rotated 45 degrees from the  
90 degree position of Figure 7 where the collar 160 is  
fitted over the now misaligned shoulders 42 and 44 to define  
25 the desired 45 or 135 degree relative positioning of the  
shoulders depending upon which side of the clamp arrangement  
is viewed. Further with the collar arrangement 160, it is  
apparent that the 0-45-90 and 135 degree positions are all  
provided without having to rotate the clamp about the axis  
30 of the leg to which the tubular member is to be joined by  
clamp jaw 24.

1 Figure 9 shows an alternative form of interconnection for  
th clamp jaws of adjacent clamps. In terms of the cross  
section for each clamp jaw it can be seen that it is the  
same as the section for the clamp jaws of the embodiment of  
5 Figure 1. In Figure 9, clamp jaw 170 has lug portions 174  
for the hinge area and lug portions 176 are provided for the  
closure device. Similarly with clamp jaw 172 it is provided  
with lugs 178 for the clamp hinge and with lugs 178 for the  
closure device. The body portions 182 and 184 of each clamp  
10 jaw have apertures 186 and 188 formed therein. The  
apertures constitute the matched portions in the area of  
interconnection of the clamp jaws to provide for the fixed  
predetermined relative positions for the clamps.

15 In the instance when it is desired that the clamps be free  
to swivel relative to one another, a standard bolt and nut  
may be used for insertion through apertures 186 and 188  
along axis 190 to interconnect the clamp jaws for relative  
rotation. However, when it is desired to secure or lock the  
20 jaws in a fixed position relative to one another a special  
form of nut 192 is used with bolt 194. Each of aperture 186  
and 188 has an interior star configuration within each clamp  
jaw body portion 182 and 184. The interior star  
configuration in terms of shape is similar to that of the  
25 internal shape of collar 160 of the embodiment of Figure 7.  
It contains 16 sides all of equal width where the sides are  
at the angles relative to one another as shown. It can be  
appreciated that inserting the nut 192 into aperture 186,  
clamp jaw 172 can be moved relative to nut 192 until the  
30 desired angular relationship of 0, 45, 90 or 135 degrees is  
obtained. Then with the aperture 188 so aligned with nut  
192 the nut is slid into aperture 188. To secure the

1 interconnections, bolt 194 is threaded into the internal  
thread 196 of the nut to make the connection where the bolt  
head includes apertures 198 into which a special tool is  
5 inserted to tighten the bolt in the nut. Bolt 192 also  
includes a flange portion 200 which abuts the internal  
surface of the clamp jaw to complete the connection.

Another form of connector for the clamps is shown in Figure  
10. The locking device generally designated 300 is used to  
fix the positions between the clamp jaws. With this  
arrangement the locking device is inserted between the clamp  
jaw faces 302. The locking device comprises two  
interlocking blocks 304 and 306. The interlocking blocks  
are identical in cross-section and are somewhat I-shaped.  
15 The interconnecting web 308 of each block has an aperture  
310 through which the connector bolt extends and which is  
coincident with aperture 138 in clamp jaw 34. Each block  
304 and 306 has spaced apart parallel ridges 312 and 314.  
The spacing between ridges 312 and 314 is essentially equal  
20 to the spacing between faces 316 and 318 of the web 308.  
This spacing is also equal to the spacing between opposing  
shoulders 44 of clamp jaw 34. Thus, the internal surfaces  
of ridges 312 and 314 fit over the surfaces 316 and 318 and  
also over the opposing shoulders 44 of clamp jaw 34.

25 With the locking device 300 in interlocked assembled form,  
and both clamp jaws 26 and 34 connected, the arrangement is  
shown in Figure 11. The ridges 312 and 314, as they extend  
to each side of the web 308, overlap the corresponding  
30 shoulders of the interconnected clamps. This arrangement  
can, therefore, provide two fixed relative positions for

1 the clamps. The reason that the ridges 312 and 314 extend  
furth r to one side of the web 308 than to the other sid is  
that the thicknesses of the w bs must be accommodated, as  
the ridges overlap the corresponding shoulders of the  
5 interconnected clamp jaws.

From this arrangement, it is appreciated that the locking  
device insert 300 may consist of a single insert which may  
be similar to block 304 where the ridges 312 and 314, as  
10 they extend to each side of the web 308, overlap the  
corresponding opposite shoulders, either 42 or 44 of the  
interconnected clamp jaws.

A variation of this arrangement is shown in Figure 12 where  
15 the locking insert 320 comprises a plate 322 having two sets  
of ridges 324, 326 and 328, 330. The plate 322 has an  
aperture 332 which is aligned with aperture 138 in clamp jaw  
34. The spacing between parallel ridges 324, 326 is equal  
to the distance between opposite shoulders 42 of clamp jaw  
20 26. Similarly, the spacing between ridges 328 and 330 is  
essentially equal to the distance between opposite shoulders  
42 of clamp jaw 34. Thus with the clamp jaws interconnected  
and the insert therebetween, the two sets of parallel ridges  
overlap and contain the corresponding clamp shoulders to fix  
25 the shoulders in one of two possible positions.

In view of the embodiments shown in Figures 1, 7, 9, 10 and  
12, it can be appreciated that the invention can be carried  
out in several forms. The embodiments of Figures 1 and 7  
30 rely on a collar or the like which engages the shoulders in  
the desired relationship to fix their position. In so doing

1 the collar is placed in tension when the clamp is under  
load. Alternatively with the embodiment of Figure 9, the  
nut 192 is placed in shear as located in apertures 186 and  
188 when the clamp arrangement is under load.

5 With either of the embodiments of Figures 10 and 12, it is  
appreciated that the two sets of parallel ridges, such as  
shown in Figure 12, may be integrally formed on clamp jaws  
26 and 34. As could be appreciated, on shoulders 44 of  
10 clamp jaw 34, ridges 324 and 326 could be integrally molded  
to extend from those surfaces. With clamp jaw 26, ridges  
328 and 330 could be formed to extend from the same  
shoulders 44. Thus, the portions on each clamp jaw, which  
are to be secured, would be the shoulders 42. This would  
15 eliminate the need for locking insert 320. When it is  
desired to provide for a swivel interconnection between  
these clamp jaws, a sufficiently thick washer would be  
placed between the jaws so that the ridges integrally formed  
on clamp jaws 26 and 34 would not interfere and permit them  
20 to bypass one another as the jaws are swivelled relative to  
one another. This arrangement could also be similarly  
envisaged with the embodiment of Figure 10, where the blocks  
304 and 306 could be integrally cast or extruded on the  
respective jaws 26 and 34, so that the ridges would engage  
25 in the manner shown. It is appreciated that this  
arrangement lends itself nicely to extruded forms of clamp  
jaws, since the parallel ridges on each clamp jaw could be  
included in the section which is extruded.

30 A further alternative is that with the embodiment of Figure  
2 and as shown in more detail in Figure 3. The collar 40  
could be integrally cast on either of these clamp jaws 26 or



1 34. This would define a recess having wall portions of a  
squar outline. These walls would then engage the square  
outlin of the shoulder arrangement provided by shoulders 42  
and 44 to mak the interconn ction. To provide for swivel  
5 interconnection, a sufficiently thick washer or spacer would  
be provided between the clamp jaw faces to ensure that the  
integrally cast collar or ridge arrangement on one of the  
clamp jaws is spaced from the shoulders on the other clamp  
jaw to allow relative rotation of the clamp jaws.

10

The arrangements are such that, particularly with Figures 1,  
7 and 10, the stresses exerted on the connecting device are  
equally distributed about the axis of interconnection of the  
clamps. This greatly enhances the strength of the clamp  
15 interconnection and provides a superior form of clamp for  
use in heavy-duty application, such as, in shoring frames.

The configuration used for a particular clamp application  
will depend on the material selection, the number of fixed  
20 relative positions desired and the flexibility in changing  
from a connection which provides for unrestricted rotation  
to a connection which provides for a predetermined number of  
fixed relative positions. In addition, the anticipated  
loads will also determine the configuration used and the  
25 thicknesses of the materials for making the interconnection  
of the clamps.

Figures 13 through 18 show various configurations for  
alternative forms of closure devices used in closing the  
30 clamps to engage and clamp a structural member. Figure 13  
shows clamp 14 with hinge 72 and closure device 202. The  
free ends 76 and 78 of the clamp jaws 32 and 34 remain the

1 same. A pin 204 is used to pivotally connect the first end  
206 of the arm 208 to clamp jaw free end 76. As shown in  
Figure 14, arm 208 of the closure device 202 is twisted 90  
5 degrees so that its free end 210 lies in a plane at 90  
degrees relative to the plane in which end 206 lies.  
Pivotally connected to the end 210 of the arm 208 is a  
manually operable cam 212 which is pivotally connected at  
pin 214. The cam 212 comprises a lever 214 and cam faces  
216 and 218. Also provided on the arm 208 is a washer 220  
10 which abuts the lugs 112 of clamp jaw 34. With the cam 212  
in the position shown in Figure 13, the washer 220 may be  
pulled against cam face 216 and the arm 208 pivoted to clear  
the free end 78 of the clamp jaw. Whether it is desired to  
close the clamp around a structural member, the arm is  
15 pivoted within the slot area 128 between lugs 112 with the  
washer on the outer surfaces of lugs 112. The cam 212 is  
then rotated downwardly so as to engage face 218 which is  
spaced further from pin 214 so as to squeeze the clamp jaws  
together around the article to be clamped.

20

An alternative form for the closure device is shown in  
Figure 15 which involves a wedged arrangement. Again the  
clamp 14 has clamp jaws 32 and 34. The clamp jaws pivot  
about hinge 72. In this instance the clamp 14 is used to  
25 clamp a piece of wood 222. The closure device 224 comprises  
an arm 226 pivotally connected to jaw free end 76 by pin 228  
which passes through yoke portion 230 of bolt 226. On the  
other end of the arm 226, a wedge 228 is mounted in the  
split end 230 of the arm and secured in position by a pin  
30 232 which extends through sloped slot 234 of the wedge. As  
shown in Figure 16 the wedge in its dotted position 228a is  
spaced outwardly of the lugs 112 of clamp jaw 34 to permit

1 outward swinging of the arm 226 which permits the clamp to  
be opened or closed. With the clamp closed about the wood,  
the arm 226 is swung inwardly with the wedge in the upper  
position 228a. With a hammer or the like the wedge is  
5 driven downwardly in the direction of arrow 236 whereby the  
sloped slot 234 moves the wedge face 238 inwardly to effect  
a closure of the clamp. As with the other clamps abutments  
36 and 38 are provided to limit the extent to which the  
clamps are closed. This is particularly helpful with  
10 material such as wood because it prevents crushing of the  
wood when the clamp is connected. Normally the clamps are  
used so that the wedge 228 is oriented in the manner shown  
in Figure 16 thereby relying on gravity to always keep the  
wedge in its lowermost position. Should the frame to which  
15 the clamp is attached be subjected to vibration such  
orientation prevents accidental loosening of the wedge.

Figure 17 shows another form of closure device where the  
clamp 240 has internal face 242 adapted to clamp a circular  
20 member. The clamp has jaw portions 244 and 246 which are  
hinged in area 248. At the free ends 250 and 252 of the  
clamp jaws, the securement device generally designation at  
254 is provided. The securement device operates on the  
principle of "over-centre" latching of the clamp jaws. The  
25 securement or closure device comprises a first U-shaped arm  
256 which is pivotally connected at 258 to lug portion 260  
of the free end 250 of clamp jaw 246. The closure device  
also includes a secured arm 262 which is pivotally connected  
at 264 to the arm 256 in the manner shown and has a rod 266  
30 at the free end of arm 262. The rod 266 mates with lug  
portion 268. To effect closure of the clamp as shown in  
Figure 18, the closure device 254 has the rod portion 266

1 located in lug 268 with the arm 256 in the position shown.  
The first arm 256 is moved in the direction of arrow 270 so  
that the pivot point 264 passes by the alignment of pivot  
points of rod 266 and of the first arm at 258. As it passes  
5 by this centre position, the pivot point 264 moves against  
stop 272 whereby outward pressure exerted by the structure  
member clamped, retains the pivot point 264 in its  
over-centre position against stop 272. This over-centre  
clamping mechanism can be very effective in applications  
10 with require snap action quick closure and quick release.

The clamp arrangement according to this invention provides  
for many different types of interconnection while retaining  
the features of unrestricted rotation of the connected  
15 clamps or connection in predetermined fixed relative  
positions for the clamps. The clamps may be formed from  
extruded aluminum alloy sections to reduce the cost of  
manufacture and provide for uniformity in making the mating  
portions in the area of interconnection.

20 It is also appreciated that in the use of collars and  
shoulders to define the fixed predetermined positions, the  
collar need not be formed of a unitary structure. It may be  
desirable to have a permanent swivel interconnection and  
25 when desired to fix them, a collar is used which is openable  
to surround the aligned shoulders and then closeable to  
secure them in position. It is also appreciated that other  
forms of interconnection may be used in providing for  
relative rotation such as a bearing arrangement which would  
30 be symmetrical about the central axis of the interconnected  
clamp jaws.

1 The clamps are particularly useable on scaffolding and  
shoring arrangements and with aluminum structures the clamp  
jaws may be extruded from aluminum alloy. As explain d, this  
is particularly useful with the arrangements wher th  
5 locking devices are integrally formed on the clamp jaw, such  
as, the parallel ridges which function in the manner  
exemplified in Figure 12. The jaws may, however, be cast  
when it is desired to provide irregular surfaces for the  
matching portions of the clamp jaws.

10

A further advantage to extruding the clamp jaws is that the  
length of the jaw can be readily varied dependent upon  
design considerations. This is useful, for example, when  
different lengths of jaws are required as determined by the  
15 load exerted on the clamp. To prevent slippage of the  
tightened clamp along the member for a given load, the  
length of the jaw is selected to provide sufficient clamp  
surface area to resist slippage of a loaded clamp by way of  
the frictional engagement of the tightened clamp on the  
20 member. In addition, the size of the shoulder arrangement  
or the like on each clamp jaw may remain the same for each  
length of clamp jaw to facilitate interchangeability of the  
clamp jaws.

25

Although various preferred embodiments of the invention have  
been described herein in detail it will be understood by  
those skilled in the art that variations may be made thereto  
without departing from the spirit of the invention or the  
scope of the appended claims.

30

1     CLAIMS

1.     A clamp arrangement for connecting elongate rigid structural elements comprising two clamps which are capable of being interconnected either for rotation between the two  
5     clamps or for positioning of the clamps in at least one predetermined fixed relative position, each clamp having a clamp body which is releasably closeable to surround and clamp a respective structural member, at least one of said  
10    clamps in the area of interconnection having at least one portion which is adapted to be secured to position said clamps in said at least one predetermined fixed relative position, and means cooperating with and containing said at least one portion for securing said clamps in said at least one position.

15    2.     A clamp arrangement of claim 1, said clamps in the area of interconnection having opposing portions which are adapted to be secured to position said clamps in said at least one predetermined fixed relative positions, said  
20    means being adapted to engage and contain thereby said opposing portions for securing said opposing portions relative to one another at said at least one position.

25    3.     A clamp arrangement of claim 2, wherein said securing means is adapted to balance the distribution of stresses on said securing means about said axis of interconnection when the clamp arrangement is under load.

30    4.     A clamp arrangement of claim 2, wherein said securing means is predominantly under shear when said clamp arrangement is under load and there are forces attempting to rotate the clamps relative to one another.

means is predominantly under tension when said clamp arrangement is under load and there are forces attempting to rotate the clamps relative to one another.

5

6. A clamp arrangement of claim 4, wherein said opposing portions have aligned apertures which are symmetrical about said axis, said apertures and said securing means which is adapted for insertion in said apertures having a mating configuration which provides for securing said clamps in the various said predetermined positions.

10

7. A clamp arrangement of claim 5, wherein said clamps are interconnected along said axis for swivel interconnection, said opposing portions presenting external proximate surfaces, said securing means cooperating with said external proximate surfaces to provide for securing said clamps in the various said predetermined positions, said securing means being placed predominantly under tension by the counter rotation of said external surfaces when said clamp arrangement is placed under load.

15

20

8. A clamp arrangement of claim 1, wherein said securing means is integral with said clamps and arranged on each clamp to cooperate with and engage the corresponding opposing portion on the other clamp.

25

9. A clamp arrangement for connecting elongate rigid structural members comprising two clamps which are capable of being interconnected for either rotation between the two clamps or for positioning of the clamps in at least one predetermined fixed relative position, each clamp having a

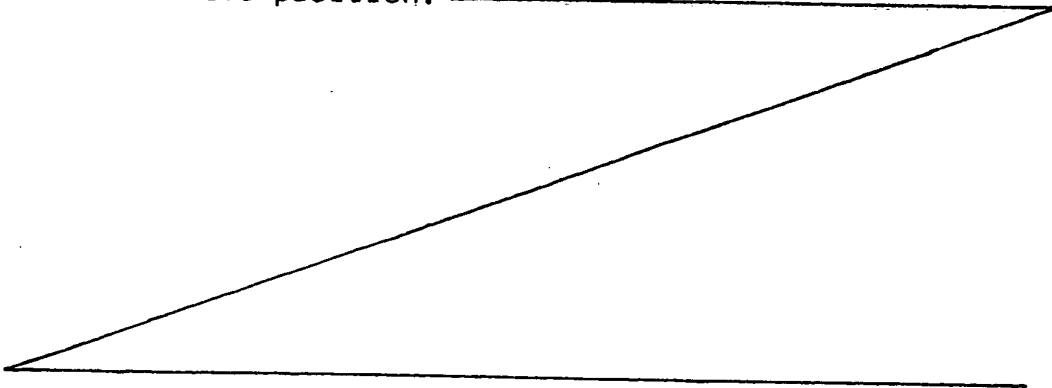
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1 clamp body which is releasably closeable to surround and  
clamp a respective structural member, said clamps in the  
area of their interconnection having opposing portions which  
have a distinct relative orientation for each said  
5 predetermined fixed relative position for said clamps, and  
means for engaging said opposing portions when they are in  
each said distinct relative orientation to lock said  
portions and thereby provide the corresponding fixed  
relative positions for said clamps.

10 10. A clamp arrangement of claim 8, wherein said clamps  
are interconnected for relative rotation about an axis which  
extends through the longitudinal axes of two elongate  
structural members connected by said clamp arrangement.

15 11. A clamp arrangement of claim 8, wherein said clamp  
opposing portions are matched and which have said distinct  
relative orientation for each said predetermined fixed  
relative position, said locking means engaging said opposing  
20 portions at each distinct relative orientation to secure  
said clamps in the corresponding fixed relative position.

25 12. A clamp arrangement of claim 11, wherein said matched  
portions of the clamps have external surfaces which are  
symmetrical about said axis, said locking means engaging  
said surfaces to position said clamps in said corresponding  
fixed relative position.





1 13. A clamp arrangement of claim 12, wherein said external  
surfaces of said matched portions comprise a shoulder  
arrangement on each clamp body, the shoulder arrangements of  
interconnected clamps oppose and are similar to one another,  
5 said locking means engaging said opposing shoulders when in  
each distinct relative orientation to position said clamps  
in a corresponding fixed relative position.

10 14. A clamp arrangement of claim 13, wherein said shoulder  
arrangement comprises at least three shoulders all of equal  
length and are symmetrically arranged about said axis.

15 15. A clamp arrangement of claim 14, wherein said locking  
means comprises a collar having an internal shape identical  
to each clamp shoulder arrangement and dimensioned to  
snugly receive and overlap opposing clamp shoulders when  
aligned to position said clamps in the corresponding fixed  
relative position.

20 16. A clamp arrangement of claims 14 and 15, wherein said  
shoulder arrangements comprises four shoulders, said collar  
having a corresponding square internal shape to provide for  
two distinct predetermined fixed relative positions for the  
clamps,

25 17. A clamp arrangement of claims 14 and 15, wherein said  
shoulder arrangement comprises four shoulders and said  
collar has sixteen internal faces all of equal length to  
provide eight pairs of adjacent faces which are at ninety  
30 degrees to one another, such arrangement providing for four  
distinct predetermined fixed relative positions for the  
clamps wherein two of those positions said matched portions

1 are aligned and at the remaining two of those positions,  
said matched portions are not aligned.

5 18. A clamp arrangement of claim 13, wherein said locking  
means has an open position to permit placement of said  
locking means around the adjacent aligned shoulders of  
interconnected clamps and a closed position for engaging  
said aligned shoulders of said interconnected clamps to fix  
them in the corresponding predetermined position.

10 19. A clamp arrangement of claim 13, wherein connector  
means releasably interconnects said clamps for relative  
rotation about an axis, said locking means having a unitary  
body portion which is engaged with the aligned shoulder  
15 arrangements of the clamps prior to completion of clamp  
interconnection by said releasable connector means.

20 20. A clamp arrangement of claim 19, wherein said locking  
means is a collar of unitary structure and having an  
internal surface configuration to engage the various aligned  
shoulder arrangements to provide said predetermined fixed  
relative positions for the clamps.

25 21. A clamp arrangement of claim 18 wherein each shoulder  
arrangement comprises four planar surfaces, all of equal  
length symmetrically arranged about said axis, said collar  
having a corresponding square internal surface configuration.

30 22. A clamp arrangement of claim 8, wherein each clamp  
body has a non-circular aperture therein defined by internal  
surfaces of said clamp body, such internal surfaces being  
symmetrical about the longitudinal axis of said aperture,

1 said clamps being interconnected with the longitudinal axes  
of the apertures coincident, said locking means being  
adapted for insertion in said apertures and bridging same to  
engage aligned internal surfaces to position said clamps in  
5 a corresponding fixed relative position.

23. A clamp arrangement of claim 22, wherein said aperture  
is defined by at least three internal shoulders all of equal  
width, said locking means having a cross section with mates  
10 with aligned shoulders to fix the relative positions of the  
clamps.

24. A clamp arrangement of claim 23, wherein said aperture  
is defined by sixteen shoulders all of equal width and  
15 symmetrically arranged about the longitudinal axis of said  
aperture, said locking means comprising an elongate insert  
to bridge said apertures, said insert having an external  
configuration the same as and for engaging the internal  
configuration of said aperture.

20 25. A clamp arrangement of claim 11, wherein connector  
means releasably interconnects said clamps for relative  
rotation, said connector means comprising means to prevent  
release of said connector means at least while said clamp  
25 arrangement is in use.

26. A clamp arrangement of claim 9, wherein said locking  
means is integral with said clamps and arranged on each  
clamp to cooperate with and engage the corresponding  
30 opposing portion on the other clamp.

27. A clamp arrangement of claim 26, wherein said locking

1 means comprises at least one ridge integral with each clamp  
adapted for engaging and thereby containing a corresponding  
shoulder portion on the other clamp body.

5 28. A clamp arrangement of claim 27, wherein each clamp  
comprises parallel external shoulders and parallel external  
ridges, the spacing between said ridges being essentially  
equal to the spacing between said shoulders, said ridges  
being essentially at right angles to said shoulders, said  
10 ridges of one clamp engaging the shoulders of the other  
clamp with the clamps interconnected to provide the  
corresponding fixed relative position for the clamps.

15 29. A clamp arrangement of claim 28, wherein said clamps  
are individually formed from an extruded section of aluminum  
alloy.

20 30. A clamp arrangement of claim 14, wherein said locking  
means comprises an insert for positioning between said  
clamps, said insert having a ridge arrangement adapted to  
engage said shoulder arrangement of each clamp when in a  
distinct relative orientation to fix said clamps in the  
corresponding position.

25 31. A clamp arrangement of claim 30, wherein said insert  
comprises a plate having two parallel ridges extending in a  
first direction and two parallel ridges extending in the  
opposite direction, said shoulder arrangement on each clamp  
having four shoulders of equal length, the spacing between  
each set of parallel ridges being essentially equal to the  
30 spacing between opposite shoulders of said arrangement.

1 32. A clamp arrangement of claim 31, wherein the first set  
of parallel ridges extend essentially at right angles to the  
second set of parallel ridges.

5 33. A clamp arrangement of claim 30, wherein said insert  
comprises two interlocking blocks, each block having means  
for securing it to a respective clamp and two parallel  
ridges and two parallel shoulders, the spacing between said  
10 shoulders being essentially equal to the spacing between  
said ridges, said ridges being at essentially right angles  
to said shoulders, said ridges of one block engaging the  
shoulders of the other block with said clamps interconnected  
to provide the corresponding fixed relative position for  
said clamps.

15 34. A clamp arrangement of claim 33, wherein connector  
means for interconnecting said clamps extends along the axis  
about which the clamps are adapted to rotate, said blocks  
having apertures through which said connector means extends.

20 35. A clamp arrangement of claim 1, wherein one of said  
clamps has at least two portions in the form of an external  
shoulder arrangement which is adapted to be secured, said  
securing means being integral with the other of said clamps  
25 for cooperating with and containing said shoulder  
arrangement to secure same.

30 36. A clamp arrangement of claim 35, wherein said securing  
means comprises a ridge arrangement adapted to engage and  
contain said shoulder arrangement.

37. A clamp arrangement of claim 36, wherein said shoulder

1 arrangement comprises four shoulders of equal length to  
define a square shoulder arrangement, said ridge arrangement  
defining a square recess having four walls adapted to  
overlappingly engage said square shoulder arrangement and  
5 thereby contain same to provide the corresponding fixed  
relative position for the clamps.

38. A clamp arrangement of claims 1, 2 or 3 wherein said  
clamps are adapted to clamp structural members used in  
10 bracing scaffolding and shoring frames.

39. A clamp arrangement of claims 9, 26 or 30 wherein said  
clamps are adapted to clamp structural members used in  
bracing scaffolding and shoring frames.

15 40. A clamp arrangement for use with scaffolding and  
shoring frames comprising at least two clamps, each clamp  
comprising two clamp jaws pivotally connected together about  
a hinge point so as to hinge from an open to a closed  
20 position for clamping a structural member used in assembling  
scaffolding and shoring frames, adjacent clamp jaws of said  
at least two clamps being interconnected for rotation  
relative to one another about an axis common to all clamp  
jaws of said arrangement, each clamp jaw having on its  
25 exterior between its hinge point and its free end a shoulder  
arrangement means which is symmetrical about said axis and  
which cooperates with similar shoulder means arrangement on  
an adjacent clamp jaw for determining when aligned at least  
one fixed relative position of adjacent clamps and means for  
30 cooperating with and engaging aligned adjacent shoulder  
means to secure them and thereby provide the corresponding  
fixed relative position for adjacent clamps.

- 1 41. A clamp arrangement of claim 40, wherein connector  
means symmetrical about said axis interconnects adjacent  
clamp jaws for relative rotation with said shoulder means  
arrangements beside each other.
- 5 42. A clamp arrangement of claim 40 wherein each shoulder  
means arrangement comprises at least three shoulders, all of  
equal length.
- 10 43. A clamp arrangement of claim 22, wherein said shoulder  
means arrangement has four shoulders, each having a planar  
surface, said securement means being a collar having a  
square internal shape for bridging aligned shoulders and  
snugly receiving the shoulders to secure them.
- 15 44. A clamp arrangement of claim 43, wherein a connector  
means is provided for releasably interconnecting adjacent  
clamp jaws of at least two interconnected clamps, said  
collar being a unitary structure.
- 20 45. A clamp arrangement of claim 40, wherein means is  
provided for closing said clamp jaws of each clamp to secure  
a structural member, said closure means cooperating with the  
free ends of the clamp jaws to effect clamp closure.
- 25 46. A clamp arrangement of claim 45, wherein said closure  
means comprises a bolt pivotally connected to a clamp jaw  
free end, the mating clamp jaw free end having a slot to  
receive a portion of said bolt, a nut for threaded  
30 engagement with said bolt to secure said clamp on a  
structural member.

1 47. A clamp arrangement of claim 45, wherein said closure  
means comprises an arm pivotally connected to a free end of  
a clamp jaw, said arm being received by a slot in the free  
5 end of the mating clamp jaw, said arm having rotatable cam  
means for engaging when rotated said mating clamp jaw to  
effect clamp closure.

10 48. A clamp arrangement of claim 45, wherein said closure  
means comprises an arm pivotally connected to a free end of  
a clamp jaw, said arm being received by a slot in the free  
end of the mating clamp jaw, said arm having a slidable  
wedge means for engaging when slid, said mating clamp jaw to  
effect clamp closure.

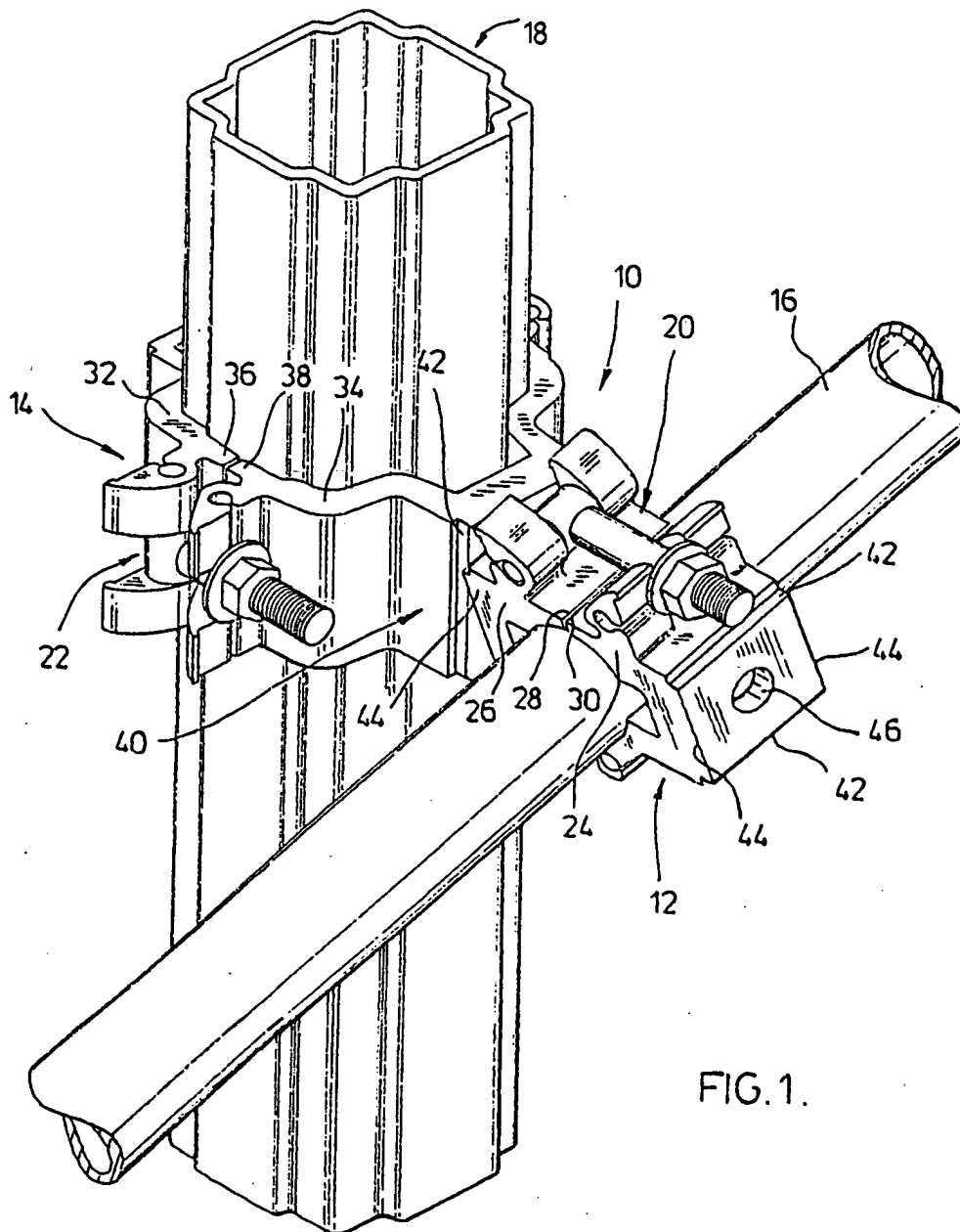
15 49. A clamp arrangement of claim 45, wherein said closure  
means comprises an over-centre action closure device having  
a first link arm pivotally connected to a free end of a  
clamp jaw and a second link arm pivotally connected to said  
20 first link arm and for engaging the free end of the mating  
clamp jaw, the engagement being such that on pivoting said  
first link arm towards said mating clamp jaw free end with  
said second link arm engaged therewith, the axis between the  
pivot points of the first link arm with the clamp jaw and  
the second link arm pass beyond the point of contact of said  
25 second link arm with said mating clamp free end to effect  
over-centre closure of said clamp.

30 50. A clamp arrangement of claims 46 and 48, wherein the  
free ends of mating clamp jaws have opposing abutment  
portions to limit the extent to which said closure means  
closes the clamp and thereby precludes crushing a structural  
member being clamped.

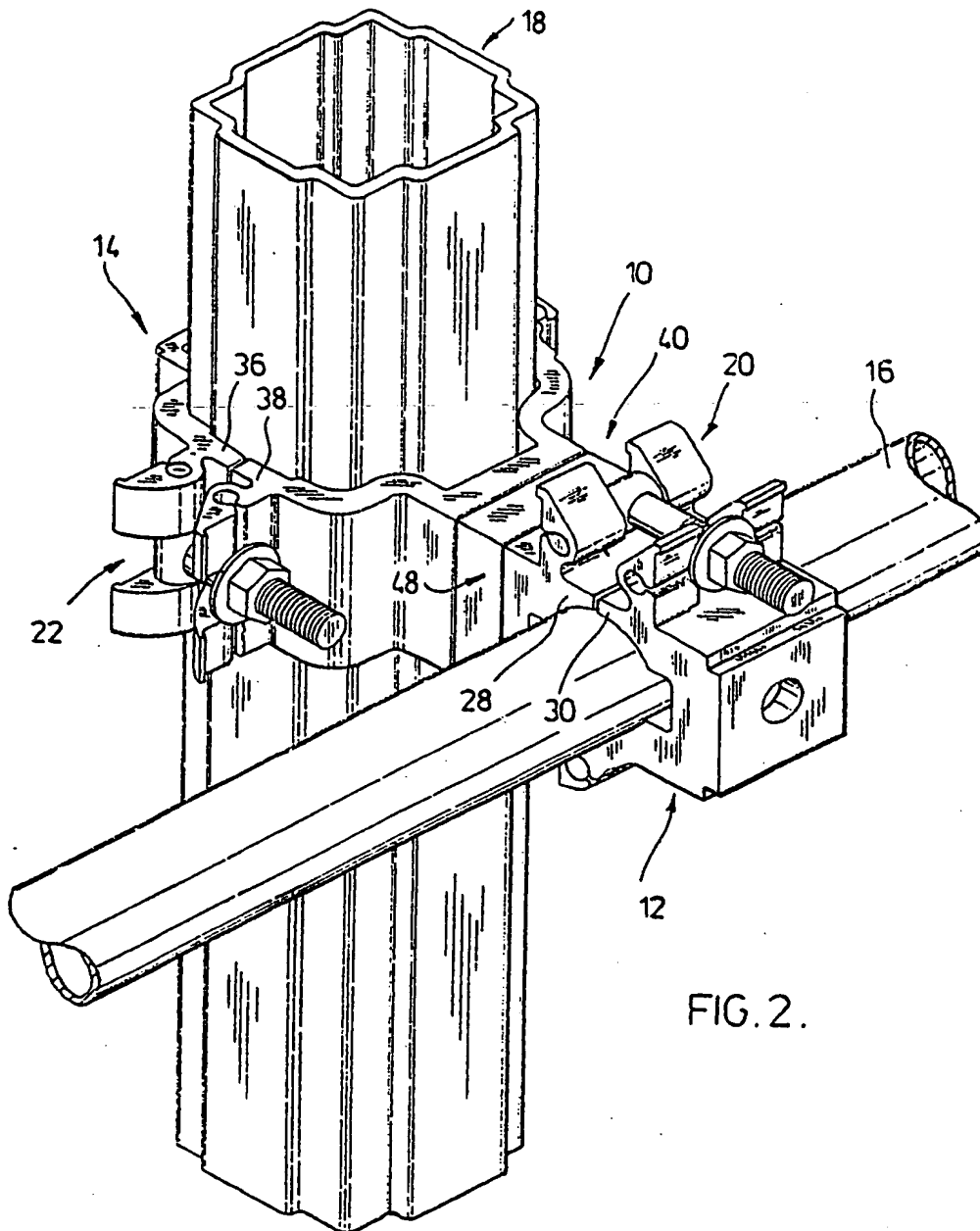


- 1 51. A clamp arrangement of claims 1, 9 or 23, wherein said  
clamps are of aluminum alloy.
- 5 52. A clamp arrangement of claim 26, 30 or 40, wherein  
said clamps are of aluminum alloy.
- 10 53. A clamp arrangement of claims 1, 9 or 23, wherein said  
clamps are individually formed from an extruded section of  
aluminum alloy.
54. A clamp arrangement of claim 27, 30 or 40, wherein  
said clamp jaws are individually formed from the same  
extruded section of aluminum alloy.
- 15 55. A clamp arrangement of claim 9, wherein said locking  
means balances the distribution of stresses on said locking  
means about said axis when said clamp arrangement is under  
load and such stresses attempt to rotate said clamps  
relative to one another.





Douglas S Johnson



Douglas J Johnson

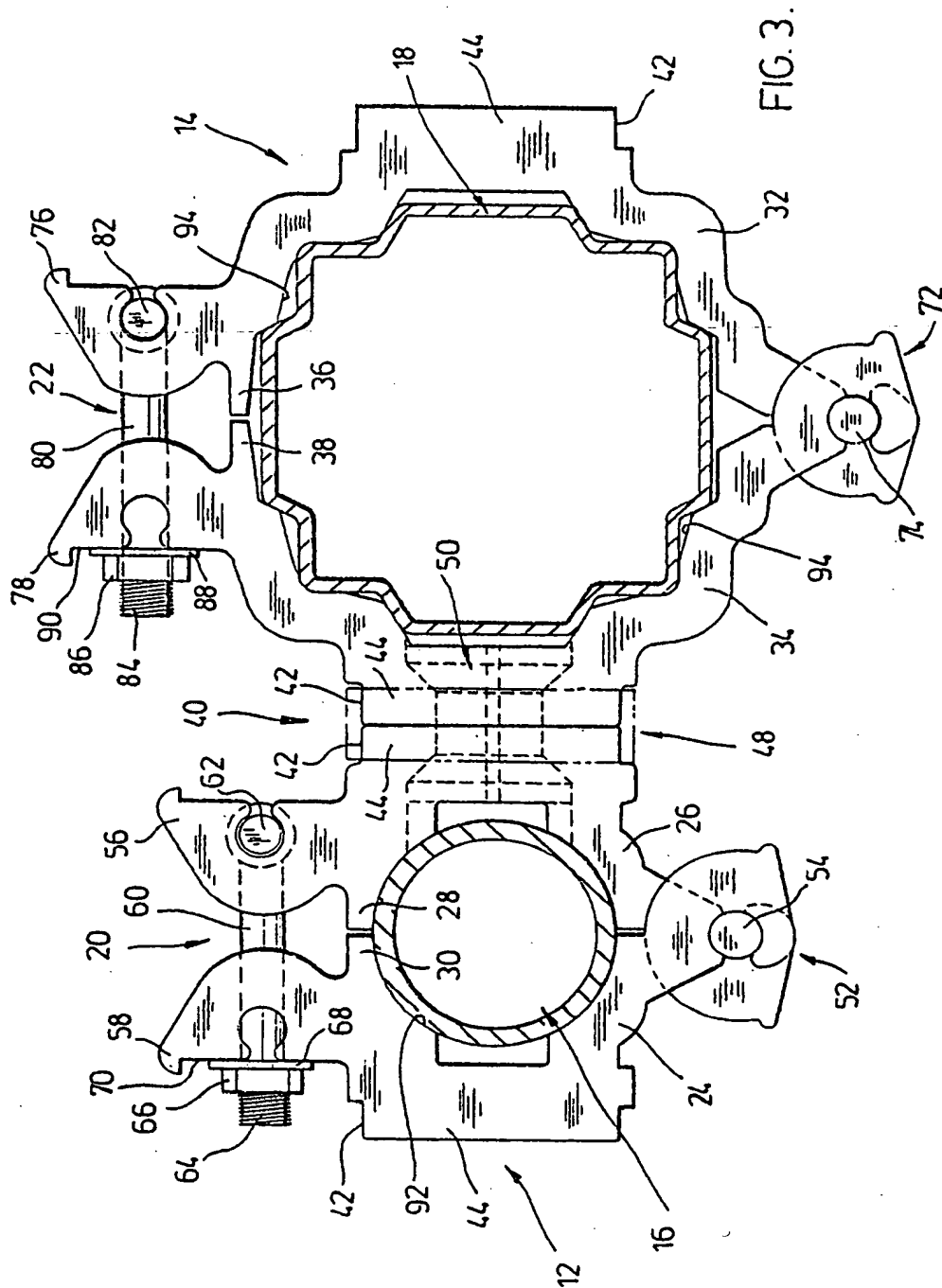
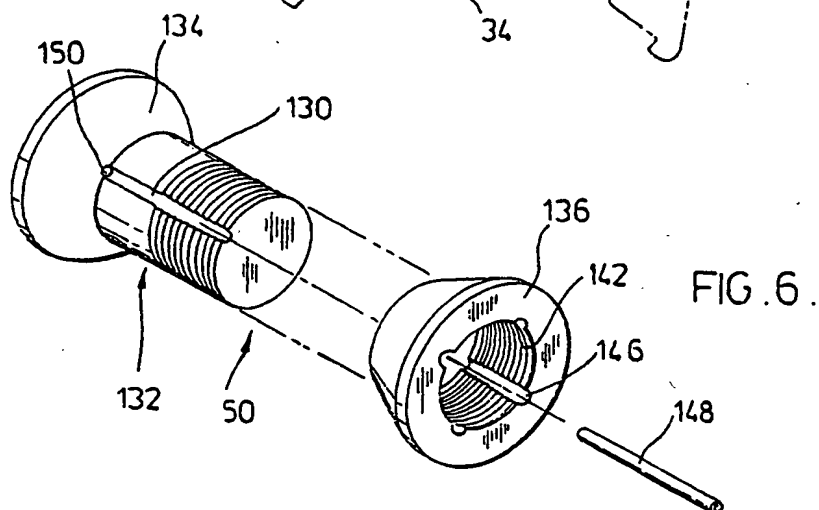
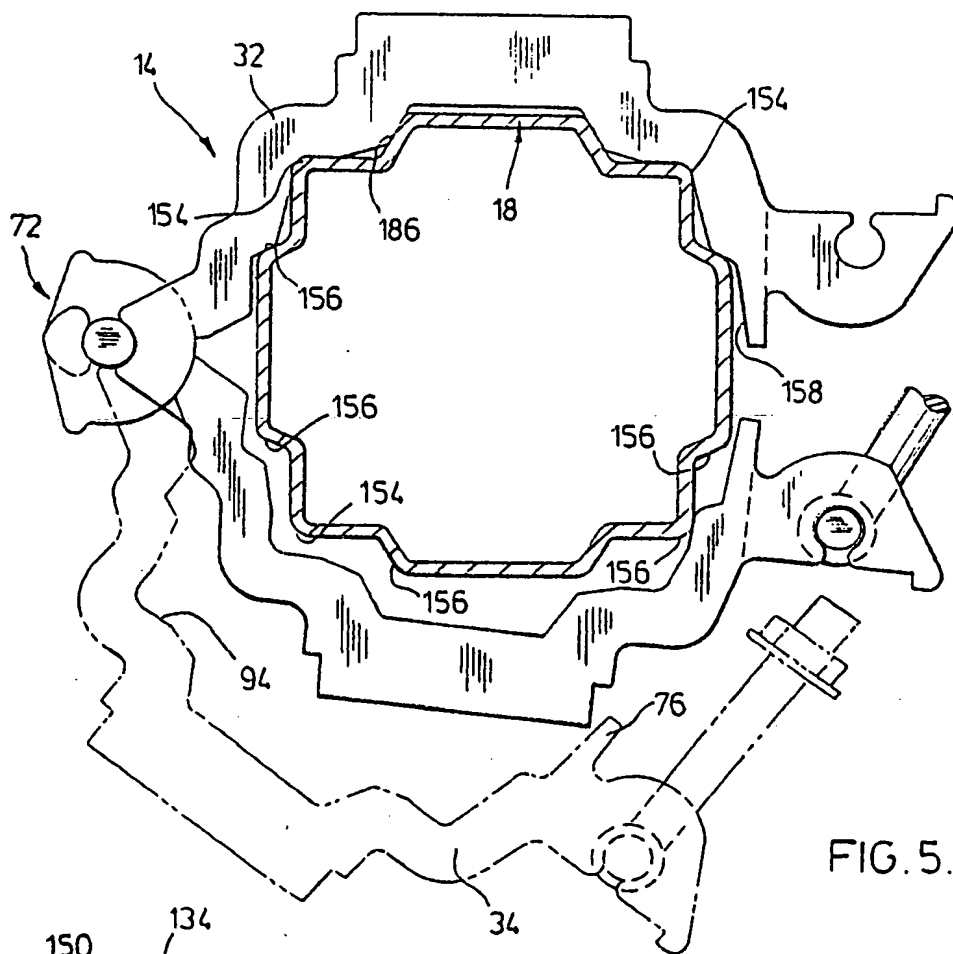


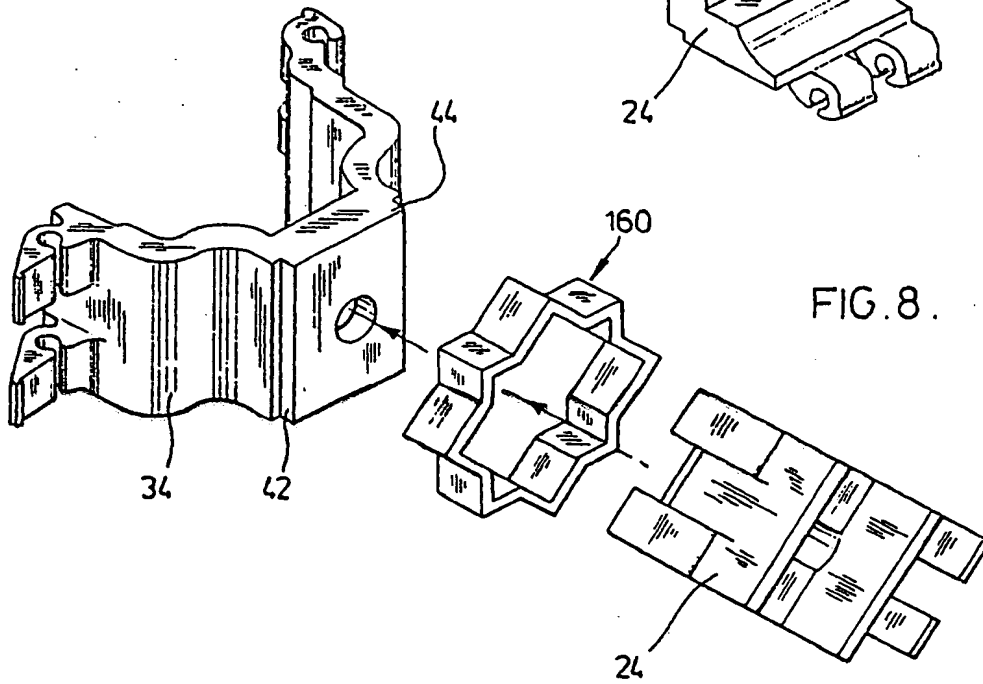
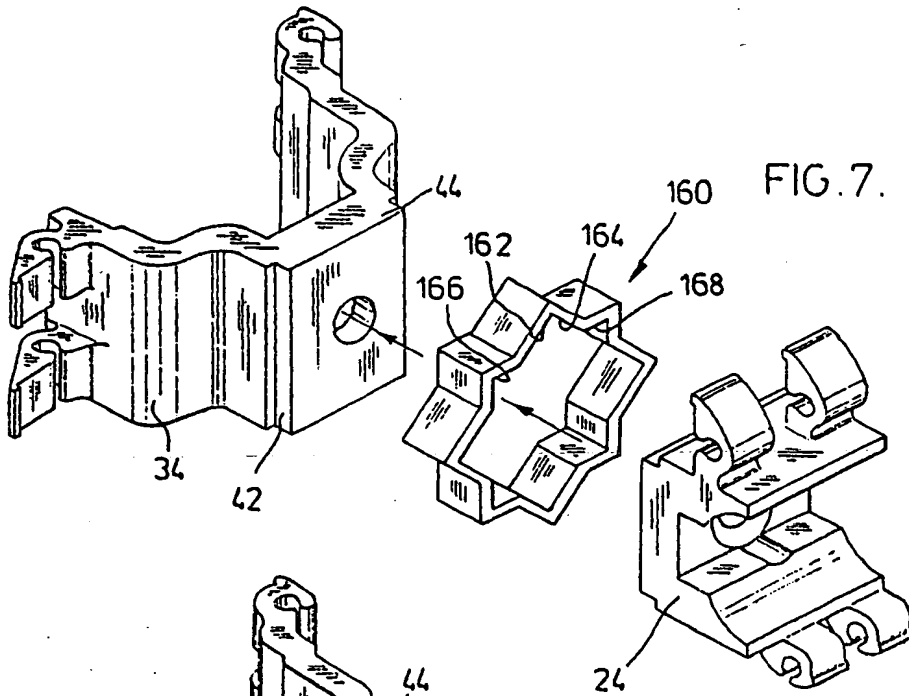
FIG. 3.

Original S. J. Johnson

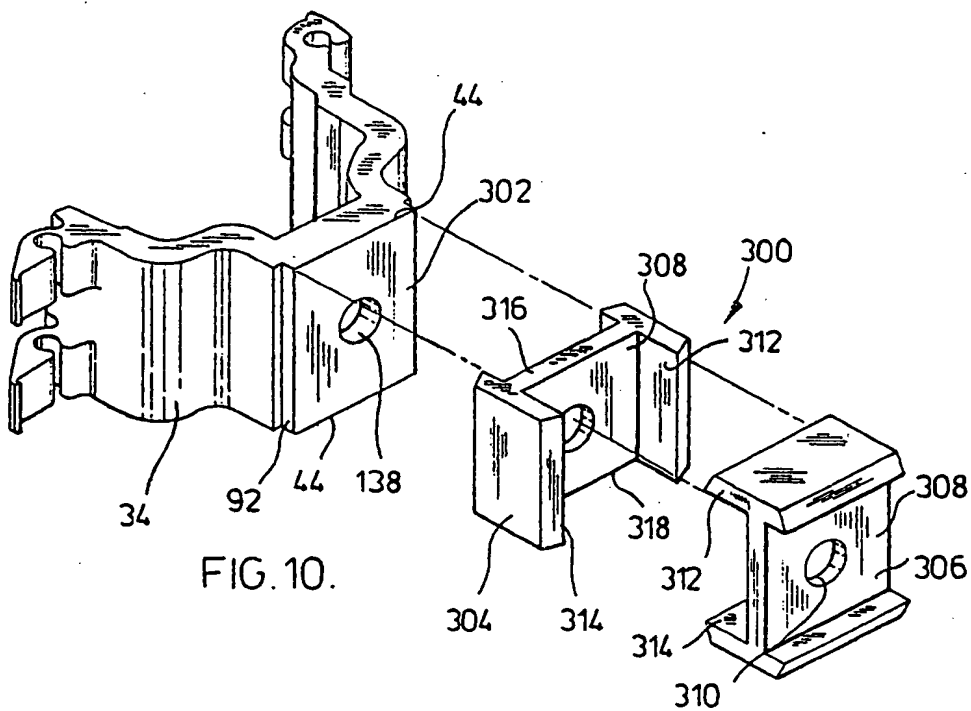
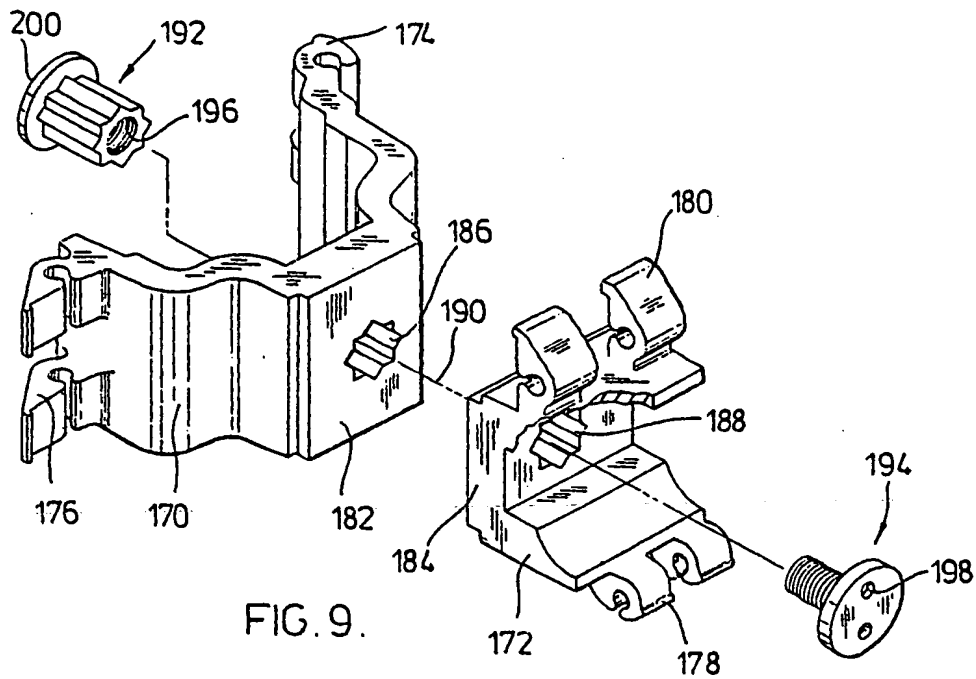




Douglas Fisher



*Marcel J. Johnson*



*Douglas S. Johnson*



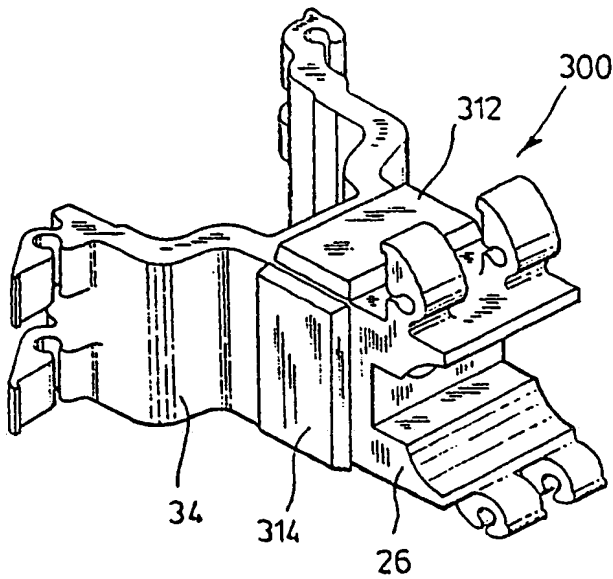


FIG. 11.

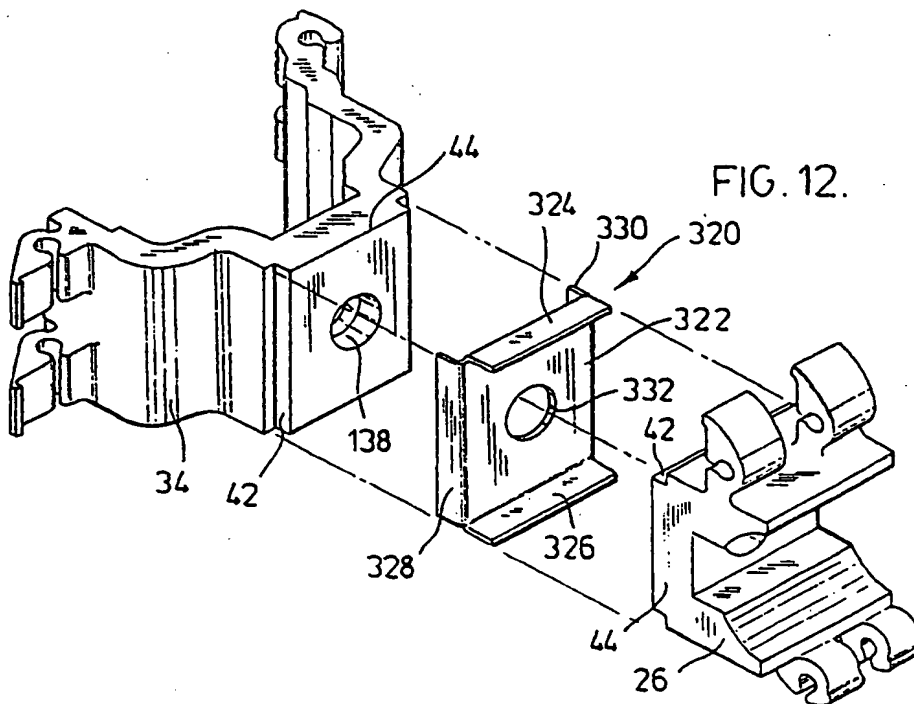
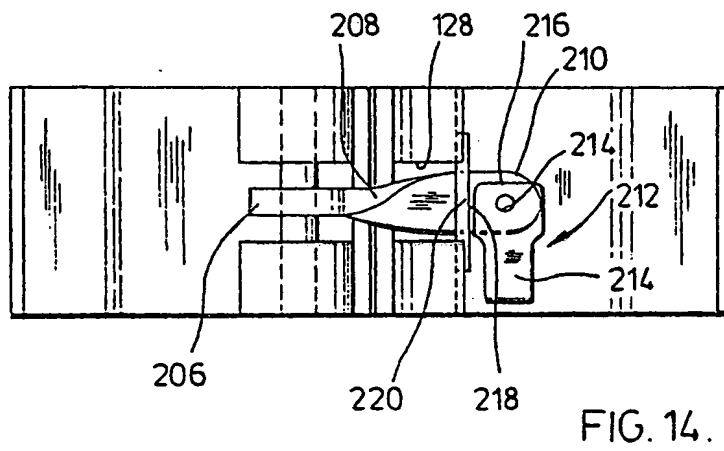
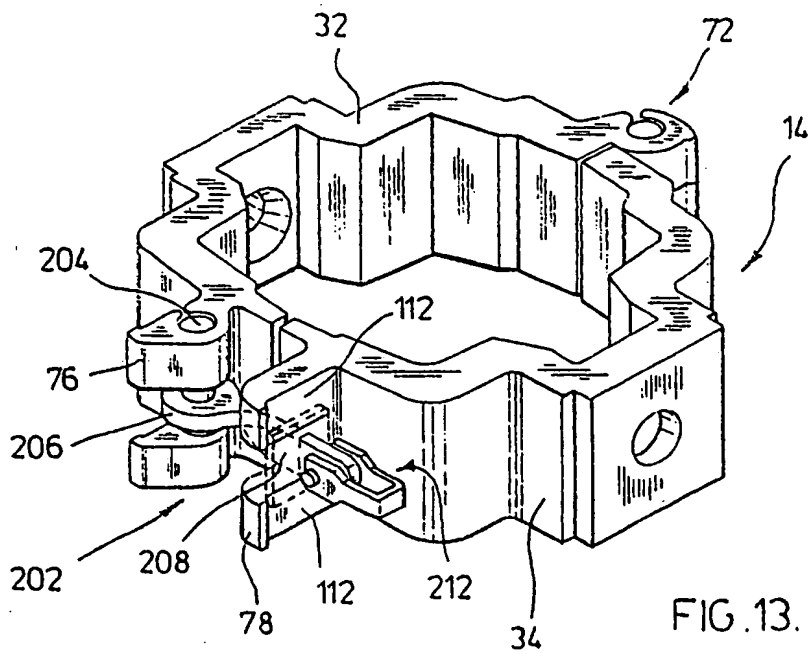


FIG. 12.

*Donald S. Johnson*



Douglas J. Johnson

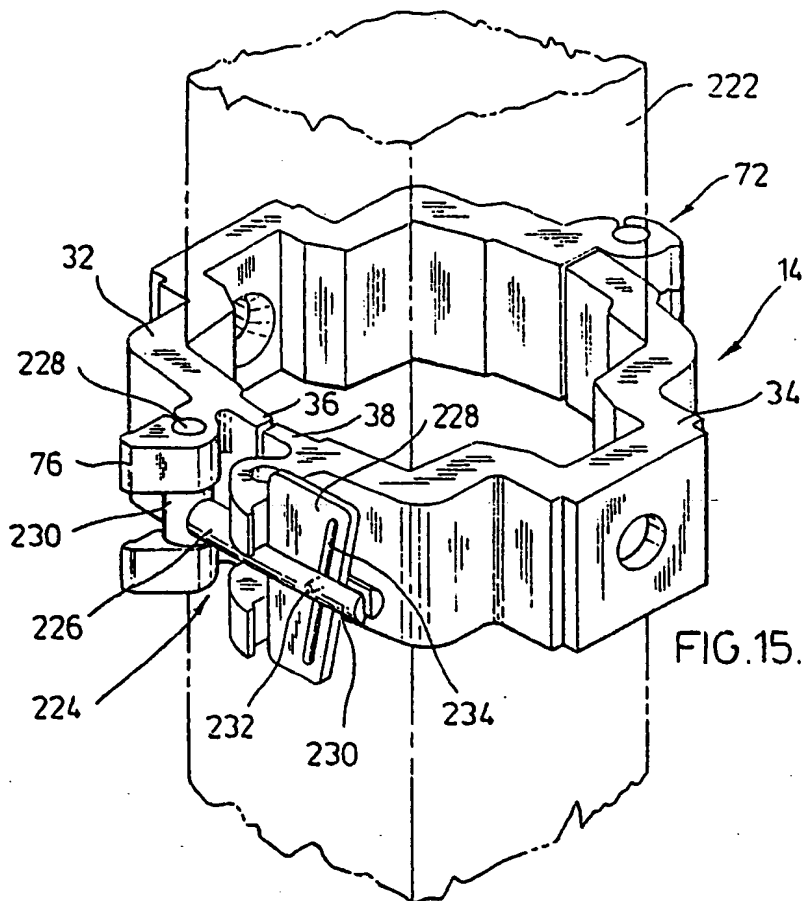


FIG. 15.

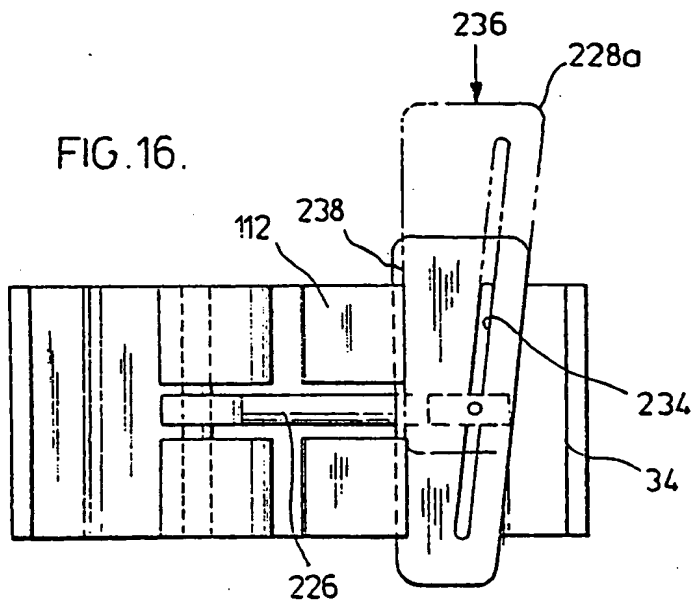


FIG. 16.

*Douglas Johnson*

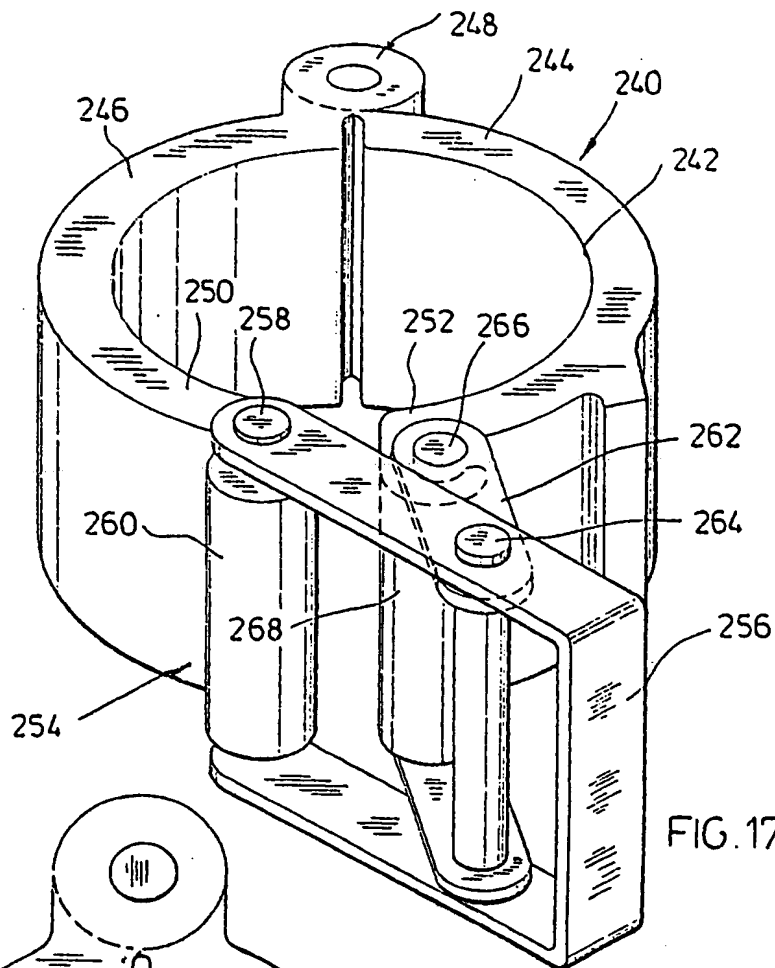


FIG. 17.

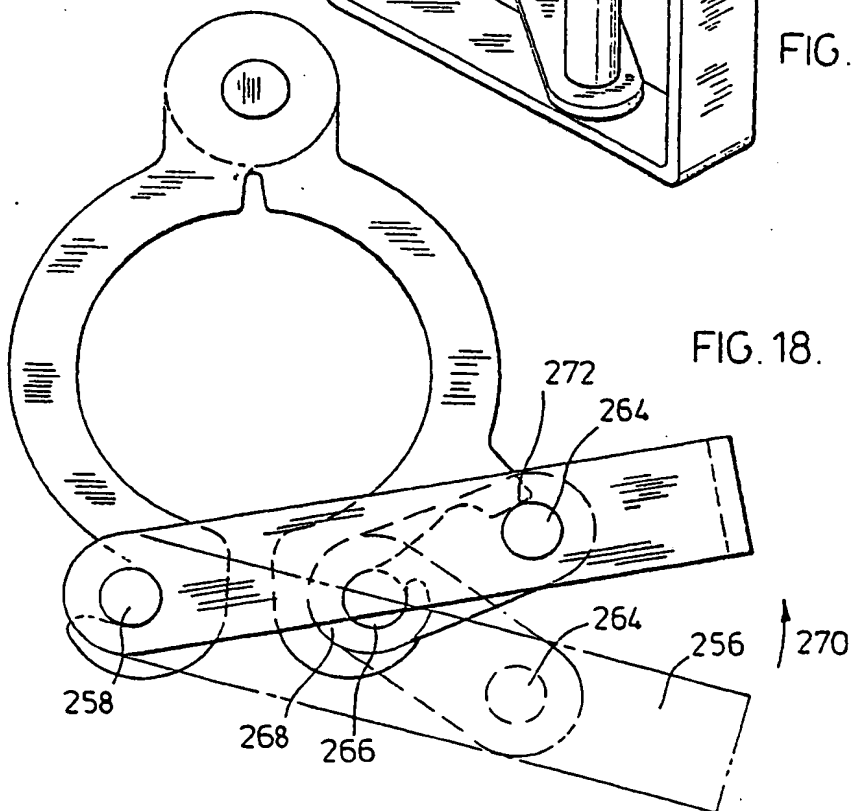


FIG. 18.

*Douglas J. Johnson*